Rendering a winter wonderland: New light transport model could improve understanding of climate change impacts

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Credit: Pixabay/CC0 Public Domain

As snow flurries mark the beginning of winter, a team of University of Waterloo researchers have digitized the white stuff into a new model that can be applied to better understand the impact of climate change.

SPLITSnow is a "light transport" model and is part of a larger body of research that simulates how light interacts with complex materials. While previous models exist, SPLITSnow is one of the most comprehensive models to date, which accounts for a variety of snowpack properties, such as density and water content, as well as the size and shape distributions of the individual grains. In addition, SPLITSnow attempts to account for the grains' crystalline makeup.

The study, "Rendering the Bluish Appearance of Snow: When Light Transmission Matters," was published in *IEEE Computer Graphics and Applications.*

The new model will also allow the team to generate important data for climate scientists around the world. Their major goal is to simulate this essential part of the ecosystem to gain more insight into fundamental environmental processes as part of the university's overall objective of being a global leader in sustainability research, education and innovation to benefit the environment, economy and society.

"One current problem facing scientists is the greening phenomenon," said Gladimir Baranoski, a professor of computer science. "Many regions of the world are seeing vegetation growth much earlier and more widely in the season cycle than they have previously, which can alter the whole balance of energy."

By understanding how the sun's light is affected by snow—and how that transmission may be altered depending on the particular characteristics of the snow—scientists can better predict how the presence or absence of snow due to climate change will affect plant growth.

"Different wavelengths can be seen as signals for different processes affecting the growth of snow-covered plants," said Petri Varsa, a Ph.D. candidate in computer science and the lead author of the research. "Some keep plants dormant, and some facilitate growth. Even small changes in the quantity and the quality of light propagated by snow may dramatically affect ecosystems."

SPLITSnow is especially exciting because it correctly models how different wavelengths of light are blocked or transmitted by snow. Snow tends to absorb reddish light with blue light shining through.

While understanding light transmission through snow has serious implications for climate scientists, it also has artistic benefits for the computer graphics industry.

"For computer graphics artists working in the animation and video game industries, this new model could be a time-saver," Varsa said.

"The computer graphics industry tends to use artists to color scenes containing snow. If we can offload some of that burden onto the computer, the artists are then free to focus on other artistic aspects that still require manual tweaking."

More information: Petri M. Varsa et al, Rendering the Bluish Appearance of Snow: When Light Transmission Matters, *IEEE Computer Graphics and Applications* (2023). DOI: 10.1109/MCG.2023.3307517

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